Patentability of Computer-Implemented Inventions and Artificial Intelligence at the European Patent Office
**The European Patent Office**

**European member states (38)**

**European extension states (2)**
- Bosnia-Herzegovina
- Montenegro

**Validation states (4)**
- Cambodia
- Republic of Moldova
- Morocco
- Tunisia

**Pending agreements:**
- Angola, Brunei Darussalam, Georgia, Lao PDR, OAPI
Industry 4.0 – The fourth industrial revolution

1st industrial revolution
steam energy, coal, transport
Hardware technology

2nd industrial revolution
electricity, oil, mass production
Hardware technology

3rd industrial revolution
electronics and IT, flight, nuclear energy
Hardware and software technology

4th industrial revolution
connectivity, software, artificial/distributed intelligence, the industrialisation of every process, renewable energy
Towards “super-software” technology

1784 | 1870 | 1960s | Today →
From Industry 3.0 to Industry 4.0

**Industry 3.0**
A computer in every home.

**Industry 4.0**
A computer in every object.
And connected.

One person, 100s of CPUs
(on wearables, medicine dispensers, watch, sports equipment etc.).
Internet of Everything (IoE)
For the patent world: the future challenge is not about IoT, IoE or Industry 4.0...

Today
Advanced machines using standard software
(advances from improving the machine)
For the patent world: ...the **future** is about innovation based on software

**Tomorrow**
Advanced software using standard machines
(advances from improving the software)
Software in automotive and medical technologies

Estimated share of European patent applications claiming a computer-implemented invention – filing years 1998 v. 2014

Source: EPO. Two random samples of EP applications in the Medical and Automotive technology areas have been screened manually for CII, and used as a second step to train a machine learning algorithm to automatically identify CII among published EP patent applications in the two technology fields. The results of the manual sorting show that 39% of EP patents in Medical technologies (priority year 2012) and 59% in Automotive (publication year 2015) were CII. The evolution of the CII share over time has been calculated using automated CII identification.
What does this mean for the patent system?

All aspects of patenting: inventing, drafting, filing, representing, licensing, standards, monetizing...

in any technological sector

will become fundamentally dependent on patent offices providing a predictable, stable and timely approach to the patenting of Computer Implemented Inventions (CII) / software, and on applicants understanding how to draft and prosecute appropriate applications
Patenting of software at EPO

**Computer Implemented Inventions (CII), not software as such**

An understanding of “technicality” and CII procedures is vital

- Interdisciplinary technical divisions of 3 examiners for each application
- Annual improvements to the CII content of the Guidelines for Examination
- Focus on CII training throughout the entire EPO operational area

**Early certainty** from search (6 months), examination (12 months) and opposition (15 months)
The European Patent Convention

Article 52(1) EPC: European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial applications.

Article 52(2) EPC: The following in particular shall not be regarded as inventions:
(a) Discoveries, scientific theories, mathematical methods;
(b) Aesthetic creations;
(c) Schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers;
(d) Presentations of information.

Article 52(3) EPC: [(a)-(d) excluded from patentability] ... only ... as such
Examination methodology

Interpretation of the EPC according to the case law of the EPO Boards of Appeal:

- **1st hurdle: Invention** (Art. 52(1), (2) and (3) EPC)
  The claimed subject-matter must have a technical character
  - any method using technical means (e.g. a computer), any apparatus.

- **2nd hurdle: Novelty and Inventive step** (Art. 56 EPC)
  The presence of an inventive step may only be supported by those features of the claimed invention which contribute to its technical character
  - i.e. those features providing a technical effect serving a technical purpose, e.g. contributing to the solution of a technical problem.
  - A non-obvious solution to a technical problem over the prior art is required.
Examination methodology

Mixed Invention

Technicality

Guidelines

Exclusions Art. 52(2)(3)

Novelty, Inventive step Art. 54, 56

Lack of novelty or Lack of inventive step

No “Invention”

Patentable
EPO Guidelines

- Index for sections related to computer-implemented inventions

- CII Guidelines Working Group
  - ongoing project 2014-2018 with representatives of all technical fields
  - revising the Guidelines to clarify and fully harmonise CII practice
EPO Guidelines – What's going on?

- **1st batch** of amendments included in **EPO Guidelines 2015**
  - G-VII, 5.4 & 5.4.1 Problem-solution approach for mixed inventions
  - B-VIII, 2.2 & 2.2.1 Search of computer-implemented inventions

- **2nd batch** of amendments included in **EPO Guidelines 2016**
  - F-IV, 3.9 Claim formulations for CIIs
  - G-VII, 5.4.2 Detailed examples of PSA for mixed inventions

- **3rd batch** of amendments included in **EPO Guidelines 2017**
  - G-II, 3.7 & 3.7.1 Presentations of information and user interfaces

- **4th batch** of amendments scheduled for **EPO Guidelines 2018 (Oct/Nov 2018)**
  - G-II, 3.+ What is technical / non-technical in further areas (mathematical methods, AI, business methods, ...)

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Mathematical methods – Technical applications

T 1227/05 Circuit simulation I / INFINEON (2006), Guidelines 2017 G-VII 5.4.2.4

- 1/f-noise:
  - stochastic process with specific properties
  - relevant for the simulation of circuits

➤ Need for a method for generating 1/f-distributed random numbers
Main idea:

Method for generating 1/f-distributed random numbers comprising:

a) determining the number \( n \) of desired random numbers,
b) computing an \( nxn \) covariance matrix \( C \) according to [...equations...],
c) computing Cholesky factor \( L \) of the covariance matrix \( C \),
d) generating a vector \( x \) of \( n \) Gaussian-distributed random numbers,
e) computing vector \( y = Lx \),
f) outputting \( y \).

Output vector \( y \) comprises \( n \) 1/f-distributed random numbers

How can the claim be drafted?
Mathematical methods – Technical applications

Method for generating 1/f-distributed random numbers comprising steps (a)-(f)
- Mathematical method as such (Art. 52(2)(a) and (3) EPC)
- **Not an invention** in the sense of Art. 52(1) EPC

**Computer-implemented** method for generating 1/f-distributed random numbers...
- Technical means (computer) are used to carry out method steps
- **Invention** in the sense of Art. 52(1) EPC

- But the mathematical method steps
  - are per se non-technical
  - they do not serve any technical purpose in the context of the claimed invention
  - they cannot therefore support the presence of an inventive step
- Claimed implementation (use of a computer): technical but obvious
- **No inventive step** (Art. 56 EPC) **over a notorious general-purpose computer**
Computer-implemented method for numerical simulation of a circuit subject to 1/f noise wherein
- the circuit is described by a model featuring input channels, noise input channels and output channels,
- the output vector is computed for an input vector and a noise vector $y$ of 1/f-distributed random numbers according to differential equations,
- the noise vector $y$ is generated by steps (a) – (f)

- Simulation of a circuit subject to 1/f noise: specific technical purpose (T 1227/05)
- Claim is limited to application of the mathematical method to that technical purpose
  - In the context of this claim, the mathematical method steps
    - contribute to the technical character of the claimed invention
    - can thus support the presence of an inventive step (Art. 56 EPC) ✓
Mathematical methods – Technical applications

Considered as **technical purposes** in EPO case law:

- **control** of a specific **technical system/process** (e.g. T 1842/10, T 318/10)
  - outside the computer, e.g. X-ray apparatus or chemical process
  - inside the computer, e.g. resource allocation in distributed computing system
- **audio/image/video enhancement or analysis**, e.g. denoising of digital images (e.g. T 208/84), estimation of quality of transmitted digital audio signals (T 1586/09)
- **data encoding** or **compression** for transmission and/or storage (e.g. T 107/87, T 212/94, T 679/14)
- **encrypting/decrypting or signing electronic communications**, generating keys in an RSA cryptographic system (e.g. T 27/97, T 1326/06, T 556/04)
Mathematical methods – Technical applications

Considered as **technical purposes** in EPO case law:

- providing a genotype estimate based on an analysis of DNA samples, as well as providing a confidence interval for this estimate so as to quantify its reliability (T 2050/07)
- **simulation** the behaviour of an **adequately defined class of technical items, or specific technical processes**, under technically relevant conditions (T 1227/05)
- **technical design** of a specific **technical system/process**, i.e. determination of optimal technical parameters (e.g. T 471/05, T 625/11)
- ...

✓
Mathematical methods – The two dimensions of technicality

In a claim to a computer-implemented method, features defining a mathematical method may contribute to technical character if:

(1) they serve a technical purpose in the context of the claimed invention
   – which is a specific, not a generic technical purpose, and
   – the claim is limited to the technical purpose,

and / or

(2) they are particularly adapted to a specific technical implementation
   – to which the claim is limited, and
   – the design of the mathematical method is motivated by technical considerations of the internal functioning of the computer.
Artificial Intelligence / Machine Learning

- **Abstract** computational models and algorithms for machine learning, such as neural networks, clustering algorithms, etc. are **not per se technical**

- **Seek protection for technical application**
  - e.g. use of neural network in a heart monitoring apparatus to identify irregular heartbeats (T 598/07)
  - classification of images, videos, audio or speech signals based on low-level features are technical purposes; also training of such classifiers (T 1286/09)
  - but classification of unstructured text documents is not considered to be per se a technical purpose, rather a linguistic one (T 1358/09)

- **Seek protection for** adaptation to **specific technical implementation**
  - e.g. implementation of neural network on GPUs
Patenting Artificial Intelligence
One-day conference at the EPO
30 May 2018
European Patent Office, Munich
epo.org/AI2018

Patents and Blockchain
One-day conference at the EPO
4 December 2018
European Patent Office, The Hague
Thank you for your attention!

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